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IT'S ALL ABOUT THE MONEY: WHY SO MANY DANISH CHILDREN DO POORLY ON PROFICIENCY TESTS

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Abstract

Mixed truncated Poisson count models are used to analyze test score results from a sample of Danish children aged 11 years in 2006. Family income, gender, parental educational attainments, and the child's physical and mental health are significant as regressors. Girls do significantly better on a sub-score based on test questions from an inductive reasoning test and a language proficiency test. Although there are smaller performance differentials with respect to gender than those based on family income, boys from low income households achieve significantly less than boys from more advantaged households. That test score performance is so dependent on household income is a surprising result for an advanced welfare state such as Denmark.

1. INTRODUCTION

The purpose of this research is to investigate what determines the academic performance of children attending primary school. While adolescents and adults have received considerable attention, those born more recently, who are the products of contemporary Danish society, have yet to be given the careful examination they deserve. To redress this imbalance, we examine the results of two achievement tests given to a representative sample of primary school children aged 11 years in 2006-2007. These tests cover the children's proficiency in logical or inductive reasoning as well as their ability to understand the structure of the Danish language.

Our results show that two variables, family or household income and gender, are by far the most important determinants of test performance, even when a large number of other traditional variables are included as regressors. By age 11 years, girls are able to outperform boys by a significant margin on both tests. The data in Table 1 show that on the inductive reasoning test, girls outperform boys by 4.9%, and on the language test, they outperform boys by 11.7%. Moreover, PISA scores for 2006 also favor girls in science and mathematics, but not in reading¹. Clearly, gender matters. But what matters more is the income level of the child's household. For the language test, boys in the top income quartile outperform boys in the bottom

¹Our test score results at age 11 years reveal a significant advantage to girls, but this is less pronounced at age 16 years for the PISA scores. Girls outperform boys by about 2% on the science and mathematics scores, but boys outperform girls on the reading score by about 6%.

quartile by a dramatic 27.7%. For girls, the differential in quartile performance is 8%, which is significantly less than for boys.

It should be noted that our findings are not unique to our sample. Similar results hold for Denmark as a whole; register data on respondents aged 23 years in 2005 reveal the same basic pattern. From Table 2 it can be seen that boys from the top family income quartile are almost three times more likely to have obtained a gymnasium (high-school) qualification than those from the bottom quartile. Likewise, girls also do much better if they come from the top family income quartile; however, their advantage over the bottom quartile is not as large as that for boys. Both girls and boys are much more likely to drop out of the educational system with no upper secondary education if they come from the bottom family income quartile.

These results reflect disturbing characteristics of the structure of Danish society: characteristics that will have profound implications on how labor markets and the marriage market will evolve. For gender, what we report here is not a uniquely Danish phenomenon; similar trends have been noted in Canada, the United States and many European countries. Although there is a substantial well-established literature in the area of child psychology and neuropsychology focusing on the differential development and performance of boys and girls academic interest in the issue of gender as it relates to educational attainment is relatively recent for Denmark. As is the case in most countries, research on gender has traditionally examined women's role

in society and why women have lagged behind men in participating in the most prestigious occupations, work less, and are generally paid less than men. As a result of this research and pressure from various interest groups—especially from the women’s movement—educational institutions and the work place have become more conducive to successful outcomes for women. Women are now much more likely to be perceived as being equal in areas that matter for their development in the labor market but which, in turn, harm the children if day-care programs are insufficient or inadequate, as has been noted by Baker, Gruber and Milligan (2008). A much newer phenomenon is the decline in the relative performance of boys and young men in schools and universities. It seems that changes in how public institutions treat women and attitudes towards what is expected of women have not only made women’s position better; they have also had a major impact on how men are able to perform in the system. One can speculate whether the trend of higher rates of female employment and the consequent changes in the way families care for their children have led to an environment that makes it much more difficult for boys to succeed. We examine the plausibility of this conjecture in Section 6.

To date, the results concerning the large differential gymnasium completion rates over the household income distribution have not been noted by other researchers and are very surprising for a welfare state like Denmark. Social scientists interested in mobility issues have often focused on parental educational attainments when they

want to see how the current generation's attainments or performance relate to that of the previous generation (Holmlund, Lindahl, and Plug, 2011). Family income has regularly been neglected as an important variable in this literature. Consequently, our approach of using family income as well as parental education is somewhat unusual, but it turns out to be especially important since performance differentials due to this income measure are so much larger than those associated with parental educational attainments. Our concern stems from the serious problems within the Danish welfare state revealed by these attainment and performance differentials. Table 2 shows that more than half the boys from the bottom family income quartile have not completed the Danish educational system by age 16 years (see also McIntosh and Munk 2012). How can this happen in a country that has such an extensive set of welfare programs, an advanced education system, and an egalitarian distribution of income?

The questions we address here are what determines the benefits gained by children from going to school and, in particular, what roles gender and economic advantage play in this process. The ability to absorb what is taught in primary school is crucial in determining how far individuals go in the school system and how successful they are in finding high quality employment when it is time for them to enter the labor market. There are reasons why the cohort whose upper secondary school achievements are described in Table 2 is so disappointing. By looking at a sample of children younger than the cohort born in 1982, which has been evaluated earlier, we hope to uncover

some of the reasons why so many children are performing so poorly in school and on test scores.

Our results on the test scores are derived from a statistical model described in Section 4 using the Danish Longitudinal Survey of Children (DALSC), which is described in Section 3. The next section provides a brief review of the literature dealing with the effects of gender and household income on test score performance. Our results are described in Section 5 and the paper ends with a discussion and conclusion section.

2. LITERATURE REVIEW

Much of the recent interest in educational issues focuses on the gender gap in university attendance. Many countries are finding that more women than men are starting and completing university. This seems to be a relative recent discovery as evidenced by two American studies, Buchmann and Diprete (2006) and Goldin et al. (2006). Both studies are concerned with the causes of the increase in female university completion rates. Both suggest that the long-standing superiority of female educational performance prior to university, the decline in discrimination against women, and the increases in the return to a university degree for women are major factors generating this outcome.

However, this result raises issues that can be examined only by investigating educational performance at much younger ages. To do this, an alternative measure of

performance is needed. Researchers interested in academic performance as it relates to gender as well as other variables, such as race, new migrants, and the economically disadvantaged, have analyzed test score results, although this is not the only measure that can be used for this purpose².

There are some American studies that analyze test scores at various ages. Both Fryer and Levitt (2010) and Pope and Sydnor (2010) find gender differences favoring boys, which in the second paper are moderated by the male/female ratio in the school class. Waber et al. (2007) also find significant gender differences but that the gender favored depends on the test. Hussain and Milliment (2008) and Duckworth and Seligman (2006) also find that boys do better on test scores. Fryer and Levitt (2004) explain Black-White differences in early test scores by using family structure variables, which have explanatory power, even conditional upon the socioeconomic status of the parents.

For household income, both Taylor et al. (2004), for 3-year-olds from households in poverty, and Heckman (2006) found large income effects, whereas Blau (1999) found only a small parental income effect on test score performance, as did Auginbaugh and Gittleman (2003) and Berger et al. (2009), who found household income less

²Buchmann and DiPrete also analyze school grade point average (GPA) for students in Grade 8 using the US National Educational Longitudinal Surveys. There are many American studies examining primary school grades as well as teacher evaluations of students. See Duckworth and Seligman (2006) for references to this literature.

important when home environmental variables were included. Shea (2000) found small effects of exogenous shocks to income except for households with a poorly educated head.

There are also some British studies that have analyzed the determinants of test scores. Gregg and Macmillan (2010) and Blanden and Machin (2008) found significant household income effects on test scores in a number of recent British surveys. Feinstein (2003) also showed a significant positive effect of household socioeconomic conditions on performance at age 10 years. Using French data on three generations Maurin (2002) found large and significant income effects on early grade transition probabilities.

There are fewer studies examining test score results for OECD countries. One study by Bedard and Cho (2010: 351), using a series of TIMSS surveys, found higher performance in mathematics and science for boys for most of the countries in the sample. Machin and Pekkarinen (2008) examined the issue of gender and found the opposite result using PISA data for 2003: girls did better on all scores for all countries, including Britain.

To summarize what researchers have found, the direction of gender effects and the size of household income effects tend to depend on the study. Typical findings are that parental education and socioeconomic status have a positive impact on test scores, whereas race and growing up in a single-parent household have a negative

effect.

3. THE LONGITUDINAL SURVEY AND THE VARIABLES

In 1996 the Danish National Centre for Social Research (SFI) initiated the Danish Longitudinal Survey of Children by interviewing a random sample of 6011 mothers of children born during September 15–October 31, 1995. All mothers in the sample were Danish citizens. The purpose of the project was to generate basic information about the child’s development and the economic and social characteristics that describe the child’s family. Repeated data collections were carried out in 1996, 1999, 2003 and 2006–7. There has been some attrition in the sample and in 2007 there were only 4971 respondents. For the last wave of the data collection, both mothers and fathers were re-interviewed and for the first time the children were also interviewed. The interview process involved an SFI interviewer visiting the household and completing a standard questionnaire. The data used in this study comes exclusively from the mother’s questionnaire for 2007 augmented by the 2003 questionnaire as some information on the educational attainments was not collected in 2007. Only respondents whose mother answered the questionnaire are used here. A few interviews were with the father; these were excluded to make the sample as homogeneous as possible, leaving a sample of 4221, almost equally divided between boys and girls.

Although all respondents were born in the same 6-week period of 1995, there is considerable variation in their advancement through the school system. Children

start school at different ages; accordingly, not all 11-year-olds are in the same grade.

The survey collected a good selection of the parents' characteristics. These included the education of both parents, whether the mother was a single parent, parental attitudes toward the value of education, parents' opinions of the quality of their child's school, whether the mother was working and if so for how long, the number of children in the family, and the income of the family measured when the child was 10 years. There is also some information on the child relevant to academic performance: the child's gender and two questions relating to the child's health. The first deals with whether the child has emotional or behavioral problems, as reported by the parent; the second relates to doctor-diagnosed long-term illnesses or impairments such as dyslexia, ADHD etc.

Two ability or achievement tests were given to all children. Although these are sometimes referred to as IQ tests, they also represent the child's level of competence in the subject because it depends on what the child has actually learned at home and in school as well as his or her innate ability. The first was a cognitive ability test, which is a Raven-type test and is known in Denmark as the CHIPS test (Children's Problem Solving Test) and is described in Kreiner et al. (1995, 2006). The second test was a language comprehension test that was first developed by Ørum (1971) and Hansen (1995) and later used by McIntosh and Munk (2007) to explain Danish tertiary educational attainments. An abbreviated version was used here to suit the

time available for each test, which was 17 minutes for the Chips test with 40 questions, and 25 minutes for the language test with 33 questions. The data for each test consist of a vector of individual responses to each question on the test. Each element in the vector is a 0 for a wrong answer or a 1 for a correct answer.

A sub-score is computed from these responses for each test score. This is the sum of the correct responses for the most informative questions. This is motivated by Schmidt and Embretson (2003: 430) who suggested that low variance questions should be eliminated from the analysis by selecting only those questions whose success rate lies between 0.3 and 0.7. The information contained in a question increases with the variance of the sample response. For the binary case, this is maximized for questions for which half the sample answered the question correctly. This sub-score is much more reliable than the sum of all of the correct answers. Means and standard deviations for the sub-score are shown for both genders in Table 1.

4. STATISTICAL MODELS

The most common procedure for dealing with test score data is by using ordinary least squares. For our data this procedure is not particularly appropriate. As a first step we applied ordinary least squares using robust standard errors to deal with the potential heteroscedasticity arising from the count nature of the data. This procedure does not address the salient characteristics of the response variable, which is integer valued. There is also the issue of unobserved heterogeneity, which is not easily handled in the

regression framework.

Our procedure deals with these features of the data by applying mixed truncated Poisson models. Truncation is required because of the small number of outcomes. Each sub-score takes on a number of values between 0 and a maximum of 7 or 8 questions depending on the test. As previously mentioned, many questions were excluded because the proportion of the sample who answered them correctly was either too large or too small.

We assume that unobserved individual characteristics can be represented by a random effect (which could depend on covariates) that takes on a finite number of discrete values. If individual i , is of type ℓ , then the probability that he or she will answer k questions correctly or obtain a test score of k is

$$\Pr\{S_i = k | Type = \ell\} = P_{i\ell}(k) / \sum_{k=0}^K P_{i\ell}(k) \quad (1)$$

$$= Q_{i\ell}(k) \quad (2)$$

where

$$P_{i\ell}(k) = \exp(-\mu_{i\ell}) \mu_{i\ell}^k / k! \quad k = 0, 1, 2 \dots K \quad (3)$$

and

$$\mu_{i\ell} = \exp(X_i \alpha_\ell) \quad (4)$$

and

$$X_i\alpha_\ell = \alpha_{\ell 0} + \sum_{j=1}^J X_{ij}\alpha_{\ell j} \quad (5)$$

where X_i is a vector of individual i 's characteristics and α_ℓ is the coefficient vector associated with type ℓ . Regressors are all normalized to have a zero mean and a unit variance. This means that the size of the regression coefficient is an indication of its importance. If the probability of being type ℓ is π_ℓ , the sample log-likelihood function is

$$\ln(L) = \sum_{i=1}^N \ln\left[\sum_{\ell=1}^{\mathcal{L}} \pi_\ell Q_{i\ell}(S_i)\right] \quad (6)$$

where \mathcal{L} and N are the number of types and the sample size, respectively. This is the ln-likelihood function used in our analysis. There are two ways of representing type. The most general is the latent class Poisson model of Wedel *et al* (1993) where all the components of α vary with type, and a special case from Heckman and Singer (1984) where only the intercept terms, $\alpha_{0\ell}$, vary by type, (see also Cameron and Trivedi, 2005 and Dahl and Lochner, 2012).

The choice of the number of mixtures to apply is an empirical issue determined by criteria involving the value of the maximized likelihood together with the number of parameters. The appropriate model to be selected is determined by the data. First, the value of the maximized likelihood function is computed using a single Poisson distribution with no covariates except a constant term. This serves as a baseline that can be used to compare other models and to construct a pseudo- R^2 for each model.

Covariates and then additional mixtures were added until there was an increase in the Akaike index.

5. RESULTS

Table 3 shows separate estimates for boys and girls for both tests³. The coefficients of the logarithm of family income are very large and highly significant. Boys do significantly less well on both tests but have larger income and parental education coefficients. Respondents with well-educated fathers and mothers do significantly better on both tests, but those with emotional or behavioral problems or learning disabilities do less well. While gender is certainly important, it is the income of the respondent's family that is the variable to which most of the explained variation in the two tests can be attributed. With the exception of some results reported in Waber et al. (2007), Heckman (2006), and Waldfogel and Washbrook (2011), this is a new result in the literature on gender differences in test score performance. Earlier literature, for example Mayer (1997), Blau (1999), and Shea (2000) played down the importance of income relative to parental education or other variables.

What is perhaps surprising is the large number of variables with no impact on test score performance. A number of other variables were used as regressors but were not significant. These include lower levels of parental educational attainment, the number of respondent siblings, parental attitudes concerning the value of education and par-

³Pooling the sexes is always rejected by the data. The income and parental educational coefficients are significantly larger as a group for the boys.

ents' perception of the quality of the respondent's school, whether the parents were cohabiting or divorced, the proportion of time the respondent's mother was working, and the overall health of the child. These variables were included as regressors in a preliminary analysis of the data but were not significant and thus are not on the list of regressors in Table 3.

The preferred model for each test and gender is a mixture of two truncated Poisson distributions where the intercept terms are the only coefficients that differ across the two distributions. Increasing the number of mixtures from two to three led to an increase in the Akaike index, indicating that two mixtures are sufficient. Latent class models, ones in which there are type-specific slope parameters, did not lead to an increase in any of the likelihood functions, so the Heckman-Singer representation with only type-specific intercept terms is sufficiently complex to explain the data. Negative binomial models were also considered, but convergence difficulties were encountered in their estimation, indicating that adding a continuous random effect to $X_i\alpha$ in equation (4) was not an appropriate way to deal with the unobserved heterogeneity in the data.

In terms of goodness of fit criteria, the models give good predictions of the first two moments of the score distributions and the proportion of respondent who do not get any correct answers. Mixing is sometimes seen as a solution to over-dispersion or excessive zeros in the data; however, these are not problems here, so the mixing pro-

cedure picked up some unobservable respondent characteristics. However, the mixing procedure gives the smallest increment to the increase in the likelihood functions. It accounts for less than 20% of the increase in the likelihood function over baseline. Using a truncated model is much more important. There are only a small number of possible outcomes, so that removing the tail of the distribution leads to a considerable improvement in the model's ability to fit the data.

What is so unexpected is that the coefficients associated with the logarithm of household income quartile are so pronounced in a country like Denmark, which is perhaps one of the most well developed welfare states in Europe with a very high standard of living. It is also interesting that these differentials in test score performance should be so visible at age 11 years, the age at which the tests were administered.

The effects of family income are even larger than those associated with gender. However, in our survey of this literature in Section 2, we found very little that would have prepared us for the result that the size of these differentials in test score performance and upper secondary school attainments is so strongly dependent on the living standards of the respondent's family. There is some information in the survey that can provide a partial explanation as to why this happens. Nevertheless, there are also some characteristics of Danish society about which there is no information in the survey that might be informative about why boys are more adversely affected than girls if they come from disadvantaged households.

The first child-health variable, h_1 , is highly correlated with family income. Having emotional or behavioral problems or not being able concentrate in school is much more prevalent in the bottom income quartile for both genders, but it is particularly large for boys. In our survey, the boys depend more on their parents' characteristics, especially household income, than do the girls so that a shortfall in the amount of resources available will have a larger impact on boys.

6. CONCLUSION AND DISCUSSION

Our two main results are that there are large differences in the way boys and girls perform on two tests measuring logical or reasoning ability and language proficiency, and that these differences are largely determined by the living standards of the respondent's family as measured by the income of the family. It is clear from Table 1 that there are very large and significant gender differences in both sub-scores by income quartile. All these differences are significant for the language test, and they are also significant for the lowest two income quartiles for the inductive reasoning test. Differentials regarding family income are very large, much larger than those associated with gender. For example, for the language test, boys from the top income quartile have a score that is 27.7% higher than that of boys from the bottom income quartile.

Our results are based on a recent survey of 11-year-olds, but they are consistent with trends that began much earlier and which characterize the entire Danish edu-

cational system. As we mentioned in the introduction, Table 2 which is based on register data for the whole country reveals much larger gender and income differentials for upper secondary school performance than those we found using the DALCS sample survey data on test scores at age 11 years. These respondents were aged 25 years in 2007 and are thus 14 years older than the respondents in our sample. Differences across income quartiles are much larger than those for our sample; both gender and family income play an even larger role in determining who has completed a gymnasium qualification. The interesting question that arises from this is whether the respondents in our sample will exhibit the same characteristics as the 1982 cohort by the time they have completed secondary schooling, or whether they differ from the older students and are less dependent on their parents' attributes. This is a crucial issue that needs to be addressed by collecting more and better data. Further research is also needed.

All studies dealing with earnings, educational attainments, or test scores find that respondent performance depends on some characteristics of the respondent's parents and variables that describe the respondent's environment when he or she was growing up. In this sense, our results are very conventional and are what researchers in this area would expect. However, what children actually get from their parents and when and how they get it are questions that have not been adequately addressed⁴. Our

⁴The debate on nature vs. nurture is a good illustration of this.

results provide insight into some of the aspects surrounding what determines success at school. The fact that family income plays such an important part in determining the test score results and later educational attainments suggests that some features of the inheritance process are more important than others.

The importance of large and significant income effects, even when parental educational attainments are included as regressors, provides compelling evidence that there are attributes, skills and abilities that children get from their parents that are probably independent of the parents' genetic characteristics. The data used in McIntosh and Munk (2007), on the importance of test scores in tertiary Danish educational performance showed that there is virtually no correlation between the three tests that were administered at age 14 and the respondent's income in the year 2000. Thus, it is difficult to maintain the hypothesis that the family income measure that is used here has any connection with the genetic endowments of the parents. Parental educational attainments may contain information related to their genetic make-up, but the effect of this on the child's test score performance is only part of what parents' education does for the child (Björklund, Eriksson, and Jäntti, (2010a:8)); the total effect of parental education is much smaller than that associated with family income.

This is because there are so many different ways that coming from a high-income family can be an advantage in determining academic success. These advantaged

households do not usually experience unemployment, are less likely to suffer from family instabilities, live in better neighborhoods, and send their children to better schools, all of which have little or nothing to do with genetics. Children from high-income households have more access to cultural activities, music lessons, foreign travel and more contact with their parents, who on the basis of their high incomes, are more likely to be ambitious, well endowed with interpersonal skills, and have most of the non-cognitive abilities required to be successful in the workplace (Borghans *et al.* (2008), Holmlund, Lindahl, and Plug (2011) and Munk (2013)). These family attributes have been shown by many researchers to be associated with academic success. As Heckman (2008) argued, the benefits of child investments and positive stimulus are larger the earlier children are exposed to them. The same could be said of the benefits of having well-educated parents, but there are many things that they cannot give their children if they are in the lower part of the income distribution. The level of income in the household represents a good measure of the totality of resources that can be made available to the household's children; this is something that parental educational attainments may not capture.

Our results are consistent with the recent claims by Björklund, Eriksson, and Jäntti (2010a:8) that the effects of environmental factors on performance are substantial and have possibly been underestimated in the literature in this area. See also Björklund, Lindahl, and Lindquist (2010b). However, they are certainly not in line

with the position taken by behavioral geneticists such as Plomin et al. (1997: 444)⁵, who deny that there are any environmental components in the mechanism whereby cognitive ability is passed from one generation to the next.

Much has been written about why girls perform better at school than boys. As we mentioned in the introduction, Danish society has changed dramatically in the last forty-fifty years with increases in female labor-force participation, which has been facilitated by the tremendous growth in pre-school institutions. That children no longer begin their schooling in school but in kindergarten has led to a downward shift in curriculum content which, as the child psychologist Sax (2007) has pointed out for the American system, has meant that what was originally taught in grade one is now what children learn in kindergarten. He notes in Sax (2001) that many boys are not prepared for this, and that they have not adapted as well as the girls have to this new regime. Many researchers in child psychology have highlighted the increase in the percentage of boys who are having difficulty in dealing with the new demands that this has imposed on them. In our study, these problem boys are likely to be characterized by the second type, whose performance is decidedly inferior to the performance of type 1 boys.

Both Sax (2007:7) and the sociologists Younger and Warrington (2005:16) have emphasized the importance of the anti-intellectual and anti-learning aspects of popu-

⁵See also DeFries et al. (1994).

lar youth culture⁶ among young males in determining their attitudes towards school. Legewie and DiPrete (2012: 4) suggest that school quality itself plays a role in determining boys' attitudes towards learning and that 'schools are an important context for socialization of young adolescents'. Based on our familiarity with the Danish educational system, this appears to be a prominent feature here in Denmark of many boys coming from low income families. Many Danish boys, like their American counterparts, are disengaged from the academic side of school and their test score performance reflects this or their basic inability to answer the questions on the tests.

Differentials in academic performance across the family income distribution that appear at the primary school level point to serious problems in the way boys from

⁶Sax writes "What's troubling about so many boys that I see in my practice ... is that they don't have much passion. Even more disturbing is the fact that so many of these boys seem to regard their laid-back, couldn't-care-less attitude as somehow being quintessentially male. 'You need to care about what grade you get. It's important' one mother told her son. 'Girls care about getting good grades. Geeks care about grades. Normal guys don't care about grades' her fourteen year old son informed her".

For the UK, Younger and Warrington say "Boys in schools in very different socio-cultural contexts, in inner cities and in rural counties have all stressed this common theme of the vital need to conform to peer pressure, to be part of the crowd and to live up to crowd norms and expectations. Unlike girls, whose interests are quite widely spread, boys' groups mainly revolve around a football culture... ."

disadvantaged families are able to take advantage of what is offered by the schooling system. As Table 2 shows, the problem is likely to get much more serious for later success in the educational system if the boys in our sample are like the average Danish male born 14 years earlier.

Unfortunately, the data collected in the DALSC survey are not very revealing about the mechanisms that cause this. Is not going on to get a gymnasium qualification a result of not being prepared and not having learned the basic skills taught at primary school, or is it due to a lack of purpose or a lost sense of direction? Recent work on time allocations in Danish households by Bonke (2009:56) shows that families with low levels of parental education devote less time to their children. This provides some insight into how the intergenerational transmission mechanism perpetuates the poor performance of disadvantaged children. However, this is by no means certain, and we are left in a position of almost complete ignorance as to why boys in general, and disadvantaged ones in particular, have such poor prospects for getting a valuable education and a good job at the end of it.

That girls outperform boys should not obscure the fact that there are also large differences across income groups for girls. Disadvantage affects both genders and this is a problem that Danish social policy has failed to fully address.

Our results show what determines test score performance without providing an understanding as to why these variables explaining it are important. We suggested a

number of reasons why family income should matter but were unable to be explicit about the mechanism whereby the children from families with higher incomes were able to do better on the two tests or were able to obtain a gymnasium qualification. If we are to come to an understanding of why children from low income families have problems at school, better sample survey data are needed. Surveys have to be able to distinguish the difference between what high incomes can buy for children and the characteristics of high-income parents that determine the quality of what these parents do for their children. School effects are also likely to be important, but it is not clear to what extent the school system favors the children from well-off families or discriminates against those from disadvantaged households. Denmark faces a potential social-educational crisis. If this is to be avoided, much more research needs to be done to understand why gender and economic disadvantage combine to generate such negative effects on young respondents.

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Tables

TABLE 1

Mean Test Sub-Scores by Family Income Quartile and

Gender. Mean and (Standard Deviation)

	Boys	Girls
	Inductive Reasoning Test	
All	3.867 (0.045)	4.060 (0.044)
Quartile 1	3.525 (0.094)	3.793 (0.091)
Quartile 2	3.661 (0.091)	4.072 (0.095)
Quartile 3	3.889 (0.081)	4.007 (0.080)
Quartile 4	4.370 (0.088)	4.392 (0.087)
	Language Test	
	Boys	Girls
All	4.208 (0.048)	4.699 (0.046)
Quartile 1	3.774 (0.097)	4.360 (0.099)
Quartile 2	3.993 (0.102)	4.487 (0.101)
Quartile 3	4.228 (0.085)	4.825 (0.082)
Quartile 4	4.818 (0.094)	5.076 (0.088)
Sample Size	1,877	1,808

Table Notes: Test 1 is the inductive reasoning test consisting of 7 questions and Test 2,

the language test, which has 8. The standard error is the standard error for the mean.

TABLE 2
Upper Secondary School Attainments by
Income Quartile Groups and Gender for
all Danes aged 23 in 2005
(Standard Deviation)

Summary Statistic	None	Vocational	Gymnasium
	Boys		
Quartile 1	0.518 (0.006)	0.256 (0.005)	0.219 (0.005)
Quartile 2	0.345 (0.005)	0.370 (0.006)	0.284 (0.007)
Quartile 3	0.236 (0.004)	0.336 (0.006)	0.427 (0.008)
Quartile 4	0.152 (0.003)	0.218 (0.006)	0.630 (0.004)
Sample Size	27,422		
	Girls		
Quartile 1	0.442 (0.006)	0.195 (0.005)	0.360 (0.006)
Quartile 2	0.283 (0.005)	0.246 (0.006)	0.470 (0.006)
Quartile 3	0.183 (0.004)	0.204 (0.005)	0.613 (0.006)
Quartile 4	0.109 (0.002)	0.109 (0.0002)	0.781 (0.004)
Sample Size	24,712		

Table note: Rows may not sum to 1.0 because of rounding errors.

TABLE 3
Maximum Likelihood Parameter Estimates For
Mixed Truncated Poisson Models

Variables	Inductive Reasoning Test	
	Boys	Girls
Intercept terms		
Type 1	1.443** (0.040)	1.639** (0.038)
Type 2	-0.950 (0.330)	-1.573 (1.828)
Ln(family Income)	0.437** (0.096)	0.153* (0.088)
Father's Education	0.003 (0.013)	0.042** (0.013)
Mothers's Education	0.039** (0.013)	0.049** (0.014)
Health Prob 1	-0.048** (0.013)	-0.080** (0.013)
Health Prob 2	-0.049 (0.013)	-0.013 (0.013)
Probability of type 1	0.946** (0.009)	0.981** (0.008)
R ²	0.049	0.052
	Language Test	
	Boys	Girls
Intercept Terms		
Type 1	1.304** (0.058)	1.563** (0.053)
Type 2	-1.116** (0.346)	-1.844 (2.149)
Ln(family Income)	0.726** (0.130)	0.308** (0.116)
Father's Education	0.037** (0.013)	0.041** (0.01)
Mothers's Education	-0.002 (0.013)	0.046** (0.014)
Health Prob 1	-0.049** (0.013)	-0.081** (0.013)
Health Prob 2	-0.048** (0.013)	-0.013 (0.013)
Probability of type I	0.948** (0.009)	0.982** (0.007)
R ²	0.048	0.055

Table Notes: * and ** indicate significant at the 5 and 1 percent levels, respectively.

Standard errors are in round brackets.